

AN
ESSAY,
TOWARDS A DEFINITION OF
ANIMAL VITALITY;

READ AT THE
THEATRE, GUY'S HOSPITAL,
January 26, 1793;

IN WHICH
SEVERAL OF THE OPINIONS
OF
THE CELEBRATED JOHN HUNTER
ARE EXAMINED AND CONTROVERTED.

By JOHN THELWALL,
MEMBER OF THE PHYSICAL SOCIETY, &c.

FELIX, QUI POTUIT RERUM COGNOSCERE CAUSAS.
VIRGIL.

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TO

HENRY CLINE, Esq.

Lecturer on Anatomy and Surgery, and Surgeon to St. Thomas's Hospital.

SIR,

IT is with no small degree of diffidence that I presume to dedicate this first effort at Scientific Investigation to you; nor could I ever so far have prevailed upon myself, had not my desire to testify the gratitude I feel for the many obligations I owe to yourself and family, been considerably stronger than my hopes, that any thing contained in this Essay could be worthy of your attention.—I do not, Sir, approach you with the venal breath of panegyric; nor can I have the presumption to hope, that any laurels can be added to your reputation by one who has yet all his own to gather; but as I am now hastening, in a new character, to the bar of the public, I am actuated by a feeling natural enough to mankind—the desire of appealing first to that decision which is likely to have the strongest bias towards lenity and indulgence. You, Sir, need not be told the disadvantages under which I have attempted to form an opinion upon an abstruse Physiological Question, which has always, even to the most learned professors, appeared to be involved in so much obscurity and doubt; and you will, perhaps, be kind enough (if my Definition should ever engage so much attention, as to be the object of conversation in those respectable medical circles you frequent) to apologize for the imperfections of a young Theorist, whose information upon the subject has almost entirely been derived (in the few hours he could steal from other studies and other pursuits) from the Lectures to which yourself, Mr. Haighton, and Mr. Ashley Cooper, have been so kind as to invite me*. I am aware,

Sir,

* It is an act of justice due to the celebrated Lecturer on Comparative Anatomy, to confess, that I never was personally at his Lectures; and that, except in the instance where I have mentioned the authority of the *Encyc. Brit.* my quotations are taken from the manuscript copy belonging to a very ingenious pupil, who, a few years ago, was a constant and diligent attendant.

Sir, that to this the ill-natured critic might reply : but why, then, intrude his puerile speculations on the world ? To this I must reply, for myself, that the reception of this little Essay in the Society,* where it had the honour to be read, was by far too flattering for a young man like myself to be insensible to ; and the solicitations of some of the most respected and intelligent members appeared a sufficient justification, in the eye of prudence, for hazarding its publication. I have, therefore, committed it to the Press, in the assurance, that, if these gentlemen have leaned too far on the side of partiality, I shall not fail to be set right again by the kind severity of some, who will incline, with sufficient force, the other way. Among these, however, will not, I am sure, be enumerated the Gentleman, whose,

With the utmost gratitude and esteem,

I have the honour to remain,

JOHN THELWALL,

Maze Pond, Southwark.

* The Essay was discussed for six successive nights to a theatre particularly thronged ; and the following Letter of Thanks was officially addressed to the Author :

Theatre, Guy's-Hospital, March 2, 1793.

S I R,

I AM desired, by the Members of the PHYSICAL SOCIETY, to return you their most sincere Thanks for your excellent and very valuable Essay, towards a Definition of Animal Vitality, the Abilities you displayed during the discussion, and the instruction which this institution has received from your Assistance in the debates.

I am, SIR,

With the greatest Respect.

Your most obedient humble servant,

George Johnson, Secretary.

J. Haighton, Praeses.

MR. THELWALL, Weston Street, Borough.

AN ESSAY, &c.

READ TO

THE PHYSICAL SOCIETY.

INTRODUCTION.

MR. PRESIDENT,

AS my sole motive for becoming a member of this society was the pleasure I always derived from the enlightened conversation of gentlemen of the Medical Profession, and as I have hitherto attended to the science only as a matter of entertaining curiosity, and not as a pursuit to which I have any present intention of devoting myself, I might, perhaps, without encountering the censure of the candid and considerate, have endeavoured to excuse myself from the execution of a task to which the nature of my pursuits must necessarily render me so inadequate. But, as I am no friend to privileges, and would have every member of society endure his proportion of the public burthens; and as, above all, I would wish to exclude the idle drone from the hive of science, I felt myself called upon to perform the part allotted by our institutions, and

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to

to give every gentleman that opportunity of canvassing and controverting my opinions, which, with respect to theirs, I have occasionally exercised myself.

I have discarded, therefore, as far as possible, the timidity naturally attendant upon the many disadvantages under which I labour, and launching into a new and untried region, have brought my little tribute of physical *knowledge*, or rather *speculation*, to the general fund ; confident only in the hope, that the smallness of its value will in some degree be compensated by the cheerfulness with which it is contributed.

My *Theory* will no doubt be found, in many respects, defective, from the want of more general information in the sciences of Anatomy and Physiology ; and may, perhaps, be erroneous in others, from the misapprehension of scattered facts, imperfectly collected, without the concatenation of circumstances by which they might be elucidated and explained. But such as it is, I am sure the society would pardon its imperfections, if they knew the numerous avocations among which it has been digested, and the small proportion of time I have been enabled to devote to its composition.

I make these observations, not to abate the ardour of controversy, or restrain the keenness of investigation. It is from that *ardour*, from that *keenness*, and not from any vague conjectures

jectures in this essay, that edification is to be expected by the society; and so far am I from wishing to shelter my hypothesis behind the screen of any personal consideration, that I should neither be displeased at being convinced that I am wrong, nor backward in acknowledging my conviction. Reputation is not to be expected from so transient an attention as I have been enabled to pay to this subject; nor can there be any disgrace in the failure of an attempt, which is the result rather of necessity than of choice.

In short, *candour of judgment*, and not *indulgence in investigation*, is what I solicit from the society; and for that I shall not solicit in vain.

It is necessary, however, before I proceed to my subject, to premise one remark. I do not here profess to delineate a perfect system. I have entitled my paper an Essay, and as such only I wish it to be considered. I shall not therefore be expected to demonstrate every proposition, or to draw out every part of my theory with amplitude and perspicuity.

This, I believe, is what has never yet been done; nor, from the limits of our present knowledge, can it rationally be expected of any hypothesis upon this subject. The Anatomical Physiologist himself is frequently left to wander in the regions of conjecture. The functions of almost every organ

may be traced farther than the existence of such organs can be detected by the minutest enquiry: Analogy, therefore, is often called upon to supply the place of Demonstration; or the more easy expedient is appealed to, of passing over in silence what cannot be readily accounted for. Many of the conjectures, it is true, which the imperfection of the senses, or the deficiency of observation, has rendered necessary to professors, have gathered confidence from the great authorities by which they have been sanctioned: yet let it not be forgotten, that it is not in the nature of authorities to change conjectures into proofs. Let us remember also, that *reason is the greatest authority of all*; and that when systems clash, and demonstrations are not to be had, we ought not to consider who is the author of this, or who of that opinion, but which it is that involves the fewest absurdities, or is best supported by analogy, and the correspondence of the general laws of Nature.

A N
E S S A Y,

TOWARDS A DEFINITION OF
ANIMAL VITALITY.

IT is an apparent paradox, but it is not therefore the less true, that those ideas, or phenomena, that are most familiar to us, should frequently be the most difficult to explain. This is particularly the case with the subject of the present Essay.

Life is a *term* so constantly recurring, and, indeed, as one would at first suppose, an *image* so perpetually presenting itself to our senses—and the difference is so striking, between the pale insensate corpse, and a living being, with all the expressions, actions, and attributes with which, in the higher scale of animals, he generally offers himself to our
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eyes, or our imaginations, that a vulgar observer would sneer at the philosopher who should suggest the difficulty of ascertaining in what vitality consists: yet where is the student, who, upon serious examination, has found himself satisfied with any thing that has been said upon the subject?

Does not the greatest anatomical philosopher, even of the present enlightened age, tacitly confess the confusion of his ideas in this respect, when he declares that, "From an examination and survey of *animal matter when dead*, only we gain an idea of *living animal matter*;" and that "as from *life* only we gain an idea of *death*, so from death only we gain an idea of *life*?"

Before we can possibly derive any sort of information from this antithesis, it is necessary that we should be instructed how life and death may be accurately discriminated; for how are we to make comparisons between objects which we are unable to separate from each other? But even this has never successfully been attempted; for though there are certain signs (as putrefaction, &c.) by which the death of the animal may be demonstrated; yet, as it is not even pretended that putrefaction is the *act of vital dissolution*,—or, in other words, that the body which is not putrid is necessarily alive—death must have taken place, independently of any such change; and we are, therefore, just as much in the

dark as ever with respect to the ultimate test by which the *presence of life* may be ascertained.

Treatise after treatise has been written on the Vital Principle; theory has pulled down theory without end; and the gross contradictions which have marked the opinions of the greatest characters upon the subject, might induce one to think that, even with respect to the *general idea*, we are still entirely at a loss; that we are seeking for an *imaginary something*—a phantom of the brain, which, perhaps, has no real existence: and, indeed, if the *term* is to be literally understood—if this Vital Principle is to be considered as a *distinct* or *independent essence*, separable from the effects and actions by which the *state of vitality* is to be ascertained, I am not sure that this conclusion will be found to involve as much absurdity as is included in the contrary opinion.

I am well aware that there are some, who, from the first blush of this observation, may be inclined to smile, and consider it as the *ne plus ultra* of scepticism: but the philosopher will do well to keep the distinction between a *vital principle*, and the *state of vitality*, constantly in his mind: the former properly meaning a *living CAUSE*—the latter simply a *modification* or *effect*, to which the *name of life* is given, and which may be *the result of a co-operation of other causes*, neither
of

of which need, in themselves, of necessity be alive.—In other words, to contend for the existence of a *Vital Principle*, is to contend that there is superadded to organized matter a distinct something, in itself alive, by which the vital functions are carried on ; while, on the other hand, the *State of Vitality* need not of necessity be construed, as meaning any thing more than the condition of the animal body during the continuance of those functions.

Now—that there is a state of animal existence, that may properly be called the *State of Life*, and be put in direct contradistinction to that of *Death*, and that upon the previous induction of this state depend all the higher functions of the sensitive being, are certainly among the most self-evident of all simple propositions. Nor is it less certain, that there must be an exact and precise moment (nay, *fraction*, or, if I may so express myself, *mathematical point* of a moment), in which this *state of life ceases*, and that of death begins ; though whether that moment can ever be ascertained by any sensible and positive mark of discrimination, is matter of considerable doubt : but if this *Vitality* is to be considered, *ab origine*, as a *Principle*, (by which, *physically* or *philosophically* speaking, I conceive is always to be understood, a *simple, elementary, and first natural cause*), and not, as itself, an effect of the co-operation of other principles, or *natural* and pre-existing causes,

I own,

I own, for my own part, I must be rather slow in yielding my assent ; and, while I bow with respect to superior judgments, must claim the prerogative of exercising my own.

Egypt, Greece and Rome are, it is true, against me :—the ancients and the moderns—Aristotle and Plato, Plutarch, Moses, and John Hunter ; and yet against this host of Giants I presume to lift my pigmy lance, and brave the unequal combat.

The most ancient of the opinions transmitted to us upon this subject, I believe, is that of the Egyptians, which considers the *Soul* (or *living Principle*) as a kind of *shadow*, or *aerial substance*, diffused through every part of the body, animating every limb, and partaking of all its proportions.

Man, according to them, consists of three parts—a *gross perishable body*—an *intellectual principle*, or *intelligent mind*, by which he is elevated above the brute creation—and an *image*, or *soul*, exactly resembling the body in shape, in magnitude and feature, upon which animation, and all the functions of the animal frame depend ; and in which, also, they conceive the intellectual principle to be enshrined.

That these were considered, in the proper meaning of the word, as *distinct principles*, is evident, since they are treated as being capable of independent existence—the *soul*, or *vital principle*, continuing many of its functions after its separation from the body; and the *mind*, or *intellectual power*, after the final separation, being sometimes consigned to a different residence from the *soul*.

This opinion (which still, with some slight variations, continues to be popular among Divines and Moralists, and has been mangled and metamorphosed even by our philosophers themselves) was adopted by the Greeks, was infused into the subtle and intricate philosophy of Aristotle, dilated upon by the divine genius of Plato, beautified by the sublime invention of that most ancient of their poets and philosophers, the immortal Homer; and, at length, was taught by Plutarch to the Roman World, in the following manner:

“ Man,” says he, “ is a compound subject, but not of two
 “ parts, as is commonly believed, because the *understanding*
 “ is generally accounted a part of the *soul*; whereas it as far
 “ exceeds the *soul*, as the *soul* is diviner than the *body*. Now
 “ the *soul*, when *compounded* with the *understanding*, makes
 “ REASON, and, when *compounded* with the *body*, makes
 “ PASSION; whereof one is the source or principle of
 “ pleasure

“ pleasure or pain—the other of vice or virtue. Man,
 “ therefore, properly dies two deaths; the first makes him
 “ two of three, and the second makes him one of two.”

This hypothesis has certainly beauty and ingenuity to recommend it to our imaginations; and is also, to my conceptions at least, somewhat more comprehensible than those systems which refer the operations of gross matter to immaterial agency. It is, however, like all the speculations of the ancients upon these subjects, unfounded in experimental enquiry, and unsupported by facts or observation: yet St. Paul, (who derived much of his inspiration from the ancient poets and philosophers) has given it the sanction of his authority, by dividing, in distinct terms, the *triune* man into Body, Soul, and Spirit.

This being the case, it is not at all surprising that modern philosophy should have been more anxious to frame such systems as were reconcileable with this tripartite division, than such as might be consistent with known facts, or maintainable on the grounds of reason; and that we should accordingly find this theory so stoutly defended to the present hour, with the slight alteration only of transposing the *soul* into the place of *mind* or *spirit*, and substituting *Vital Principle* in the place of *soul*. Some philosophers, however, by considering

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the *immaterial essence* as the animating principle, and others, by considering the *animating principle* as the only medium of intelligence, have reduced human existence to a two-fold nature: I, for my part, shall simplify the subject still farther—and, regarding man as differing from other animals rather in the extent than in the nature of his powers, shall consider him, together with the inferior tenants of creation, in an individual point of view only; as consisting of a simple organized frame, from the susceptibility and presence, or the non-susceptibility, or absence of stimuli in which arises the whole distinction between the *living* body and the *dead*. Wherever there is a perfect organization of the animal substance, there, I conceive, we have the *susceptibility* (or, as it may, perhaps not improperly, be called, the PRE-DISPOSING CAUSE) of Life: whatever may be that specific stimulus, by which such susceptibility may be disposed to be excited, that, I conceive, must be admitted to be the REMOTE CAUSE, or agent by which Life is to be produced: from the intimate combination of these results, that meliorated or altered state of the organized frame, which may be considered as the PROXIMATE CAUSE; and the Vital Action, as it may properly be called, or the power by which the vital functions are performed, being the ultimate effect of these co-operating causes, is, in reality, as I humbly presume, to be considered as that Life, or Animal Vitality, for which, under so
many

many denominations and imaginary forms, the Philosopher and the Medical Professor have so long been seeking.

Such is the general idea, which, upon the simple principles of materialism, I have formed of life; and so to define this idea as to account for the phenomena, without appealing to the fanciful creations of the visionary brain, or abstruse and unmeaning terms of pretended science, is the task I have undertaken.

But before I enter more particularly into the subject, it will be necessary to bestow some consideration on another theory that has lately very much amused, and, according to my judgment, misled the scientific world—The theory, I mean, of the Vital Principle being resident in the blood.

This doctrine, in all probability, had its origin in the remotest antiquity; since the fatal consequences that result to the animal frame, from the spilling of this important fluid, must have been frequently observed, especially in the ages of barbarism and violence, long before the faculties of man were sufficiently improved for refined speculations, or philosophical researches into nature: but the prejudices of ignorance have *sometimes* been *ascertained*, and *more frequently adopted*, by the luminaries of science and the world; and this hasty opi-

nion (for such to me at least it appears) has not wanted supporters among those who will long continue to claim the applause and admiration of mankind.

And first, I must particularize, that this doctrine has received the direct sanction of the great Jewish Law-giver (or whoever was the author of the Five Books of Sacred History generally ascribed to him) in the following, among a variety of texts of a similar nature—“ *For it is the life of all flesh; the blood of it is the life thereof: therefore I said unto the children of Israel, Ye shall eat of the blood of no manner of flesh: for the life of all flesh is the blood thereof; whosoever eateth it shall be cut off.*”

I am very well aware, that the sublime language of Revelation is not always to be interpreted with philosophical precision—the enthusiasm of divine inspiration frequently elevating the style of the holy penman to a degree of poetical hyperbole, which would be perfectly unintelligible to the cold perceptions of reason and enquiry, if it were not for the friendly appeals of the commentator to mystical allegory, and metaphorical elucidation: but as the doctrine here quoted is merely illustrative of the simple mandate, that the Jews should not eat of the blood of animals slain for their sustenance, there can be no doubt of its being intended to be literally understood

understood as the opinion of Moses, that the blood is absolutely the Vital Principle.

For this opinion, I am very much inclined to suspect, that no better foundation will be discovered than the acknowledged fact, that when the blood, or any very considerable portion of it, is drawn away, the vital functions of the animal will cease: but, unfortunately for this theory, these functions will also cease, without the proportion of this fluid being at all diminished: and as there are also several other parts entering into the composition of the animal, which, if subtracted, even in part, resign the body to inevitable destruction, we might as well say, that the stomach thereof, or the kidneys, or the liver thereof, *is the life thereof*, as that the blood is to be so considered. Nay, from what we are now acquainted with concerning the nervous system, there would be much better reason to suppose, with some later philosophers, that the life of the animal is in the *brain*, rather than in the *blood*, since so much of the latter may be lost without essential injury, while the former cannot receive the slightest wound without bringing on immediate dissolution; and though, upon serious reflection, there is every reason to believe, that the fatal catastrophe is produced as much, at least, by the consequent extravasation of the blood, as by any immediate susceptibility of injury in the substance of the brain;

yet this does not weaken the argument, since it is evident, that it is not the loss of blood from the vessels which is the real cause of the mischief (for much larger quantities may be drawn from the same part by mere external wounds, without any alarming consequences); but that the injury produced by the extravasation results from the consequent oppression on the organ, by which its active energy is restrained and benumbed, and, of course, its vital functions will be stopped.

From this, and a variety of other considerations, it is evident that the brain is, at least, more vital than the blood, since the compression of the former is more dangerous than even a very considerable deduction of the latter.

But it might, perhaps, be objected to the whole of this reasoning, that many animals have life, which have neither brain, nor kidneys, nor liver, nor, strictly speaking, even stomachs; for I know not how the simple cavities of the *leech* or *polipus* can, in strict propriety, be considered as stomachs.

This objection being founded in truth, it is necessary that we should give it its utmost force, and admit it as a demonstration, that animal life neither consists in, nor is absolutely dependant

dependant upon any one of these particular organs: but as it will be admitted, that though they have not these, they have some other organs, which, as far as is necessary for the performance of their functions, supply the place of these, the cases will still be found to be in some degree parallel—for, strictly speaking, many of the most imperfect animals have no blood (at least, according to the general idea which is given of it in the descriptions of anatomists), there being, perhaps, as much difference between the ichor, which supplies its place in several classes of insects and reptiles, and the compound fluid, which, in the more perfect animals, we call by the name of blood, as between this ichor and the sap of vegetables, and a variety of other simple juices of animal or vegetable substances. If, therefore, the *Vital Principle* is to be sought in the circulating fluids, we ought rather to say, that *the SERUM thereof is the life thereof*, than the BLOOD.

But as I am informed, that the immortal Harvey upheld a doctrine similar to that I am combating; and as so great an authority as John Hunter has thought proper, in some degree, to sanction the opinion, it is necessary to treat it more at large, and to abandon the cursory observation of the Jewish Law-giver, for the more elaborate and practical researches of the British Anatomical Philosopher.

I have said, that John Hunter's 'Theory functions, *in some degree*, the opinion of Moses ; for I think it very doubtful, whether he means to carry it to the full extent, and to assert, that the Vital Principle is peculiarly, or originally, in the blood. The Editors of the *Encyc. Brit.* it is true, (*title* BLOOD, vol. iii. p. 313), evidently understood him in this manner, as will appear from the following quotation : " The
 " uses of this fluid are so various, and of such an important
 " nature, that some have not scrupled to affirm the blood to
 " be actually possessed of a living principle, and that *the*
 " LIFE of the whole body is derived from IT. This opinion
 " was first broached by the celebrated Harvey," (*this I have*
*already shewn to be a mistake **), " the discoverer of the circu-
 " lation : but in this he was never much followed ; and the
 " hypothesis itself, indeed, has been pretty much laid aside
 " and neglected, till of late that *it was revived by Mr. J.*
Hunter." After which are quoted the six arguments, (which I shall presently endeavour to examine) as advanced by that great professor, to support this broad and unqualified opinion : but, in the manuscript copy of his Lectures, which I have principally made use of, he begins the subject with the simple assertion only, that the blood " is en-
 " dowed with a principle of life, in itself, *equally with the solid*
parts."

Now,

* Vide p. 13. of this Essay, where it is shewn to have been the opinion of Moses, &c.

Now, whether all or any, either of the particular fluid or solid parts,* possess *in themselves* (that is to say, either separately, or absolutely) a principle of life, I do not at present enquire, because it seems to involve the general question, (which must be referred to its proper place in my Essay); namely—Whether life itself is to be considered as a distinct and positive essence, or, simply, as the result of a particular harmony and correspondence of the whole, or aggregate combination, preserved and acted upon by a particular stimulus? On this subject, indeed, it is sufficiently evident that I have the misfortune to differ from the illustrious authority before me; but as I am now examining the doctrine only of the Vitality of the Blood, it is but necessary for me just to observe, that as nothing more is directly asserted in the proposition, than that the blood of the living body is *equally* alive with the bones and ligaments, and muscular fibres, &c. of which such living body is composed, it does not seem to lie considerably in the way of my theory; because, if in other respects I can but substantiate my opinion, the difference will not be very great, whether we admit the *blood* as participating in the Vitality, produced as I shall endeavour

* I treat the word parts here, not as alluding to limbs or proportions, but as referring to the separate and different species of substance of which the body is constituted—as bone in contradistinction to muscle, muscle in contradistinction to nerve, nerve to membrane, and the like.

deavour to shew, or consider *it* as nothing more than a specific fluid, giving nourishment to the various substances, and conveying to the different organized parts the necessary stimuli, by which Life or the Vital Action is to be produced or sustained. Nay, when he afterwards proceeds to assert, that "Blood is not only alive itself, but also, by circulation through every part of the body, becomes *the means of*, " and *carries Life* to, the other parts;" I do not yet perceive the absolute necessity of entering the lists upon this part of the subject, because he does not palpably assert, that the Life to be conveyed is, *sui generis*, or originally *in the blood*; but only that this fluid is the agent by which the Vitality is communicated to the respective parts; and it is my intention to admit that the blood, in the *more perfect*, and the serous fluid, substituted in its place, in the *less perfect* animals, is the appropriate medium, by which alone the stimuli necessary for the production and sustenance of Life can be absorbed and properly diffused through the organized frame: and, indeed, several passages might be produced to countenance the suspicion, that this justly admired Lecturer so far agrees with the Theory I mean to enforce, as to admit that the Vital Principle is, at least, *sustained* and re-invigorated (if not absolutely generated), not independently by the blood itself, but from something imbibed in its passage through the lungs; for he acknowledges, that "Before blood is capable of *giving* life,"

life," (in other words, according to his own theory, before it is alive), "it must have circulated through the lungs, where " it undergoes some essential change. Perhaps," continues he, " it is *then* in its second state, or vivification."

It is obvious to remark, that if the blood is not " in its state of vivification" till it has passed through the lungs, Vitality cannot be the property of the blood itself, but only a consequence of some *action*, or *superaddition*, acquired in its passage through that organ; and, consequently, that the *Vital Principle* (to use the language of those philosophers who consider Life as a separate essence) is to be sought, not in the blood, but in that subtle element, or whatever it is, which is imbibed by means of the respiratory system.

But (if it is not presumption for me to say so) there seems to be some degree of *obscurity*—perhaps, if I were speaking of any man but John Hunter, I should venture to say *contradiction*, in the doctrines of the Lecturer, upon this subject; for he immediately afterwards denies that the blood derives its Vitality from its passage through the lungs, in the following words: " Perhaps it might be thought that " Life is given to the Blood in the Lungs in consequence of " the heat applied there, as heat is supposed to act upon the " Egg; but it must be remembered, that *Life is not given to*

“ *the Egg by heat, only action produced by it.*” By which it should seem that he means to be understood as considering the Vital Principle to be *a property of the blood itself* (so long as it continues in its perfect state) independent of respiration ; and that this action of the Lungs is only necessary for the purposes of circulation, and the production of action in the other parts of the frame, by the distribution of this principle.

And yet, if the Egg be alive (which, let it be remembered, I do not positively admit), how can this be ? since (previous to the alteration taking place, from the application of heat, during the period of incubation), it contains no blood whatever ; and, consequently, if the *Vital Principle* be in the blood, must be alive without the principle of life—a paradox, which, perhaps, it would be a little entertaining to hear the advocates of this doctrine explain.

Not, however, to dwell upon so ambiguous a passage, there are, in the Lectures of this truly great man, sufficient foundations for the opinion apparently entertained by the Editors of the work above quoted, as well as by several of his pupils and admirers—namely, That he means to represent *Vitality*, or, according to his own expression, the *Vital Principle*, as residing originally, and in an emphatic sense, in the
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blood,

blood, and derived from it to the other parts of the system. He even, in the clearest manner, affirms its *superior vivification* over the nerves in particular: for while these, according to one of his aphorisms on the *Vitality of the Blood*, are not concerned in "conveying life to parts, but only direct "the motions of the parts," the blood is explicitly affirmed not only to "convey life to the other parts," but to be absolutely "the *living support* of the nerves themselves:" by which it is evident, that we must understand not only that the *nourishment* of these sensitive organs, but even their *Vitality*, is derived, not from their organization and the stimuli (of which they are, perhaps, the important repositories, or reservoirs), but from the Vital Principle peculiarly resident in the blood, and deposited there for the purpose of being communicated and diffused to other parts.

These other parts then being dependant (according to this theory) upon the blood, not only for their support and enlargement, but, also, in an immediate view, for their Vitality, it is clear that if the system of the Lecturer does not go the whole length with Moses, of saying that the blood of the animal is the life thereof, at least that he supposes Life, of itself, and independent of any particular *action* or stimulus to belong to, or be a property of, the blood; while to the rest of the animal substance, it only belongs in a secondary signification,

signification, as being imparted by the blood. And this, perhaps, we are the more bound to consider as his real meaning, as he maintains the doctrine of its vitality even after coagulation; and even delivers it as his opinion that this phenomenon "is owing to an action of self-preservation in the blood, or to an effort for its continuance." So that, according to this position, and the arguments that follow upon the circumstance of coagula becoming vascular under particular circumstances, we are not to consider the vitality of the blood as the consequence of its state, condition, and harmony, with the other *parts** of the body, but to look upon it as a principle inherent in it, and equally a property of it, whether in one state and situation, or another—whether in its vessels, or in a state of extravasation—whether in a fluid or a solid form—a circumstance attributed to no other of the component parts of the animal frame: these being considered as having no other principle of life, but what they immediately derive either from the blood, or from their harmony with the system in general; whose resources must cease before any material change in their nature and substance can take place. And yet, if this argument is properly sifted, I question whether it will make much for the Vitality of the blood, in any point of view whatever. For as no similar change in any other fluid was ever brought forward as an evidence of a Vital Principle in such fluid, I cannot

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* Vide Note, page 19.

see that any phenomenon, that would not be considered as a proof of Vitality, or of an effort of self-preservation, in any other instance, should have such stress laid upon it, for such purposes in the case before us.

With respect to the generality, probably to all, of the fluids capable of *congelation*, it might, perhaps, be objected, that they afford no parallel example of permanent change of structure; as they are capable of resolution to their original form, which blood is not. But petrified substances, in which the change is permanent and entire, might at least be said, in this respect, to have as good a claim to the attributes of a vital principle and action of self-preservation, as the blood, which is here said to metamorphose itself into something else, in order to continue its existence. Besides, if the coagulation of the blood be an action of its Vitality, and an effort of its Vital Principle for its preservation, how comes it that it will coagulate after having been frozen; for John Hunter admits, that what he calls the Vital Principle of the Egg, is destroyed by freezing; and, indeed, nothing is more injurious to vitality of every kind, than the frigorific process: and yet Mr. Hewson informs us, that blood may be completely frozen, and preserved in that condition (as other dead animal substances may) for a considerable time; and yet, after it is again reduced, by an increase of temperature, to its fluid form, it will coagulate just as usual.

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Having thus examined the general state of the question, I shall preceed to review the six arguments brought forward upon the authority of the lecturer, in the Encyclopedia, in support of the opinion previously quoted—(*vide page 18 of this Essay.*) For the more ample statement of these, however, (not to swell my Essay to an unnecessary length, by quotations from a book, which is in the hands of every body) I shall refer to the work itself.

With respect to the first of these, derived from “the power which the blood possesses, of uniting living parts,” it is to be remembered, that this is only the case in those instances where blood is immediately supplied by the parts to be united, and where, consequently, from its temperature, its assimilitude to the parts with which it is to enter into combination, its glutinous texture, and a variety of obvious reasons, it may naturally be supposed to form the best cementing medium; and the healing of wounds, by other applications, which have evidently no Vital Principle, appears to me sufficient to shew, that this is no proof of Vitality. All that is requisite, in either instance, being to keep the living parts in contact, and exclude the air, and other injurious, extraneous particles, till Nature has a sufficient opportunity of exerting her restoring powers.

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The blood, yet warm, and fluid from the wound, may naturally enough be expected to enter intimately into the different portions of the severed parts; and all further injuries being thus prevented, it is neither singular nor strange, that the separated vessels should again unite, from the attraction of similar particles so frequently observed, when circumstances are favourable to the experiment; and that the stream of blood, driving towards its usual course, should at last find its way again through the coagulum formed by the blood thus bound up with the injured parts, and complete their restoration.—2 and 6. Exactly upon the same principle I account for the phenomenon from which the second argument is drawn; namely—That “coagula of extravasated blood will become vascular:” for this, I believe, is never the case, except when the coagula come in contact, or nearly in contact, with arteries previously formed. This, therefore, seems to prove nothing more than that coagulated blood, when preserving a proper degree of temperature, from its situation, is the proper medium, or soil, into which the arteries may strike and ramify—all living parts, perhaps, having a tendency to grow and enlarge, so long as sufficient stimuli are supplied, and the proper medium is presented. For my own part, I cannot but observe, that all the preparations I have seen, intended to support this argument, have only suggested a process similar to that observable in vegetation, where the moist earth, in contact
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with the roots of plants or trees, supplies the proper medium into which the fibres are stimulated to extend their growth. And hence it is, that I find no difficulty in accounting for the junction of the testicle of the cock, to the liver of the hen, into whose abdomen it had been introduced, as mentioned in illustration of the first argument ; or, for the vascular appearance of the coagulum, found between the separated parts of the fractured *os humeri*, upon which the *sixth*, or rather the reiteration of the *second* argument, is founded.—3. As for the third argument, drawn from the power of the blood, to preserve an equal degree of temperature in the living body, during the prevalence of different temperatures of the atmosphere—I shall at present make no other answer to this, than by observing, that if the Theory I am about to suggest is well founded, *that* will be sufficient to account for this phenomenon, without appeal to any other hypothesis : for if the air may be admitted to be *sufficiently impregnated* with the same specific stimuli in the coldest, as well as in the hottest day, there can be no reason why the blood should be expected to have a lower degree of temperature on the former than on the latter—whether it be admitted to be possessed of a Vital Principle independent of such stimuli, or not.—4. As for the “ Blood being capable of being acted upon by a stimulus,”—this is saying no more than may be proved of a variety of things that have confessedly no pretensions to life
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whatever: and as the only particular effect which is instanced as produced by the stimulating influence on the blood, (namely coagulation), would never be admitted as a proof of life in any other fluid whatever, it cannot, as far as I am able to discover, be made any use of in illustration of the point in question. 5. The fifth argument, that "the blood preserves life in different parts of the body," is equally applicable to the Theory of the Lecturer, and to my own; for, whether it be considered as retaining in itself the *Vital Principle*, or being the sole medium through which Vitality can be produced, we must equally admit its importance, not only in preserving, but in diffusing life: I shall therefore only observe, that the collateral part of the argument, which asserts, that "when the nerves, going to a part, are tied, the part becomes paralytic," is, I believe, overthrown by later experiments; and that sensation only, and not the power of acting the muscles, is interrupted by the ligature of nerves. Upon this, however, (as I certainly do not mean to rob the blood of its vital honours, to bestow them on the Brain and Nerves), I shall not at present enlarge; but shall conclude what I have to say upon this subject, by observing that, perhaps, the whole doctrine of the Vitality of the Blood (in whatever point of view it may be taken) originated in the mind of the Lecturer, from observing the important offices it performs in the sustenance and reproduction of parts confessedly

fessedly and palpably alive. Now, that the nerves (for example), as well as every other part of the animal body, are nourished by the blood, is sufficiently evident, and that, but for such nourishment, these parts must, by exhaustion, lose their Vitality, is equally obvious; but that the fluid, nourishing and sustaining a living part, must of necessity be itself alive, is what I cannot readily admit, because it seems to contradict the known laws and phenomena of nature. Air and water are the proper and necessary nourishment of plants, without which vegetation must quickly be exhausted and expire; but no one will, therefore, contend, that air and water are alive: nor will the difficulty be removed, by objecting, that air and water are only the *food* of plants, and that the nourishment of the vegetable is *immediately* derived from the circulating sap, as that of the animal from the blood; for as no digestive process can be assigned to the plant, air and water must be the *immediate* nourishers of the sap; and, consequently, the conclusion must either be, that the *living sap* is nourished by air and water, which *are not alive*, or that the *sap, which is not alive*, nourishes the *living plant*; which, with respect to the argument before us, is just the same: in short, it might as well be maintained, that *whatever supports a sensitive part must itself be sensitive*; or that nothing but nerve should nourish a nerve, or muscle but muscle, &c. which would drive us back to the obsolete opinion of those philosophers,

phers, who maintained, that all things contain the component parts of all things; and, in short, would even compel us to appeal to the doctrine of an ancient sect of Atheists, who, to get rid of the necessity of a Deity, insisted upon the original and eternal Vitality of matter, and accounted for the growth and nourishment of living things, by arguing, that the particles that nourished them were themselves possessed of a living principle. If, however, we abide by the mode of reasoning suggested by the known phenomena of nature, a much more simple theory will present itself, in the evident tendency of small accumulations of matter (when placed under favourable circumstances) to assimilate, and even identify themselves with the larger masses to which they adhere, or with which they enter into combination; which will sufficiently account for the nourishment and growth of the living body, without attributing Vitality to the blood, by which it is sustained.

Having thus taken as brief a survey as the nature of the subject would permit, of some of the principal opinions, that have, at different times, commanded the attention of the scientific world, I shall proceed to the professed object of my Essay; namely—to consider of the Definition. Of this undertaking the difficulty must be readily admitted; or, should pride or petulance be inclined to deny it, the subterfuges to

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which

which the most ingenious ornaments of medical science have been driven, would furnish a sufficient reply. Some have given it up entirely, and satisfied themselves with a *negative test*, instead of a *positive definition*; asserting, that the only criterion of its absence is putrefaction: but these cautious maxims, though they may be adopted, for security, by the practitioner employed in the benevolent labour of snatching from premature dissolution the pale victims of accident or despair, will not satisfy the spirit of the philosophical enquirer: he, indeed, may frequently be *compelled* to wander in the gloom of doubt and negation; but his active mind will scorn such sullen darkness, and pant for the glorious prospects of truth and certitude; to which, however, I have not the arrogance to profess that I shall conduct him.

By some it has been contended, that life consists in *action*, or excited irritability; by others, simply in organization: but both of these would admit a variety of instances, that can lay no claim to any sort of Vitality, much less to that sort of Vitality which is the subject of the present paper: with respect to the former, I need only instance, that parchment, leather, thread, &c. may be excited to considerable action by either heat or moisture, as may also a variety of light bodies, by the application of electricity: and, as for organization, this I consider to be no other than *that arrangement*
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of dissimilar parts, by which a harmony and communication of the whole is produced, so as to enable it to preserve itself in a given state, and resist its own dissolution. This, therefore, is very inadequate to our idea of life ; for matter will continue to be organized when LIFE has ceased ; as it also, I conceive, must be organized before LIFE begins ; in illustration of which, I should rather be inclined to quote the instance of the Egg, which (with all the deference due to the high authority of John Hunter) appears to me *to be organized*, though *not alive*, previous to incubation : I conceive also, that many bodies may be considered as organized, that were never intended to live at all. To those, however, who wish to consider life as entirely dependant on Organization, I submit the following Definition : *That perfect harmony of organized parts, by which the animal frame is rendered so far susceptible of the proper stimuli, as to have its functions, or any of them, induced upon such stimuli being applied :* and this the Society will be kind enough to keep in their minds, as what I mean, when I come hereafter to speak of *Specific Organization*. — Others have considered Animal Life as consisting in the performance of the Animal functions : but this definition would exclude, from all pretensions to Vitality, many beings, which common sense must admit to be alive ; for an animal may certainly live, when it neither does, nor can perform, all its functions ; and, as for ascertaining which may be dis-

pensed with, and which may not, this, I believe, has never been successfully attempted.

The definition of John Hunter appears to me particularly vague and unsatisfactory. "*Life*," says he, "*does not consist in any modification of matter* : it either is *something superadded to matter*, or else it consists in a *peculiar arrangement of certain fine particles of matter*, which, being thus *disposed*, acquire the properties of Life." The Disciples of this justly celebrated man must pardon me, if I am inclined to smile at this definition, or rather indefinite description of Life, and to declare, that I never in my life met with any thing more completely incomprehensible. "Life does not consist in any *modification of matter* ;" and yet, perhaps, "it consists in a *peculiar arrangement of certain fine particles of matter*, which, being thus *disposed*, acquire the *properties of Life* !" What is the *fineness* of these particles of matter, but a *modification of matter* ?—What is the *peculiar arrangement*—what the *disposition* of these particles, but a modification of matter ? In short, is not this telling us, in other words, that Life positively *is not a modification of matter*, but that yet, perhaps, it *is a modification of matter* ? As for the other position, that Life consists in *something superadded to matter*, I had once occasion to controvert this incomprehensible axiom at the Lyceum, when, all of a sudden, a sneer went round

round the Theatre, and a hundred mouths were filled with fury against me, as though I had stood up, in the presence of the Pope and his Cardinals, to deny the doctrine of the Trinity. I shall venture, however, once more to assert, that the spiritual allusions of this sentence are too fine for the gross conceptions of my material organs. According to my dull comprehensions, *matter* and *vacuum* stand precisely in the same degrees of contradistinction as *something* and *nothing*; and, in the former case, as in the latter, it is impossible for me to admit *the negation of the one*, without, at the same time, acknowledging *the affirmation of the other*.—*Where there is not matter, there there is vacuum;—where vacuum is not, there there must be matter.* Those effects, which are not produced by the operations of some *modification of matter*, or, in other words, of *something*, must of course be produced by some *modification of vacuum*, or, in other words, *of nothing*; and how vacuum, or nothing, can be so modified as to produce Life, I leave to the consideration of the Metaphysicians. It is evident, however, that this is not what the Lecturer means; because, though he denies the modification of matter, he admits the superaddition of *something*.—But what is this *something that is not matter*?—Is it *Spirit*? I certainly do not think it the part of a philosopher absolutely to deny the existence of every thing that he cannot demonstrate; but, as contradictions are not to be admitted, I must, for my own part, maintain, that if there is any such *thing* entering into the animal composition

composition (though our senses have never yet been capable of taking cognizance of it) as *Spirit*, having an existence separate and distinct from organization, and that gross perishable kind of substance we call body, that such *Spirit*, however subtile, however refined, must still be material: and then, indeed, the absurdity vanishes—because that more subtile matter can act upon that which is more gross and inert, we have sufficient evidence in the action of air, and of the electric fluid. And that this (a fine and subtile, or aëriiform essence) is the real and genuine meaning of the term *Spirit*, about which divines and philosophers have so long been contending, is, I conceive, sufficiently demonstrable, not only from its etymology, but also from the common application of the word in the other senses in which it is still retained: as, for example,—by the spirit of any distilled or fermented fluid, we always mean to express that more subtile and volatile principle (the *alkohol* of the chemists) mixed with, and diffused through such fluid, and whose materiality (notwithstanding its superior subtilty) is no more to be questioned than that of the grosser parts of the fluid with which it enters into combination. In short, it will perhaps be found, that all Nouns, immediately or arbitrarily derived from Verbs,* whether of the same, or any other language, still retain,

* The natural mode of derivation seems to be of the Verb from the Noun; this being evidently likely to precede in the first rude attempts at language: but there are many words now in use, which must have come to us in the contrary direction—as *Heaven*, for example, which still retains, simply and absolutely, the meaning (that which is *beaved* or *lifted up*), which it brought from the parent verb, *to beave*.

tain, in a considerable degree, their paternal signification; and spirit must, perhaps, be admitted to bear no other meaning than the Latin *spiro* (*to breathe*), from which it is confessedly taken: or, if we must needs make a distinct living existence of it, then can it possibly mean no other than a vital aëriform substance, diffused through the frame, and giving animation to the respective parts. So that, at any rate, this *something superadded to matter*, can only be a more refined species of matter added to that which is more gross; and, of course, it constitutes that very modification which the Lecturer denies.—It has been stated, in defence of this passage, that by some *thing* superadded, no more is meant than some *quality*; but this would by no means mend the matter, since nothing can be added but what has a previous and separate existence. Two things brought together may, it is true, occasion the existence of a third, different from both; but this third is not added, but produced. Now *qualities* have no separate existence, nor can they even be conceived in the imagination, otherwise than as connected with the things of which they describe the shades or attributes: they are, in fact, solely and purely, modifications of matter, and, consequently, this interpretation involves all the absurdity and contradiction of which I have before complained.

But it is much more easy to find fault with the definitions of others, than to frame such as are not faulty: I shall proceed,

ceed, therefore, to my task with caution ; and, beginning with a general, proceed to a particular definition.—Life then, in the animal, we will say, is *that state of action, by which the functions, or any of the functions of the animal, are carried on.* This definition, it is true, neither points out how the action is supposed to be induced, nor the state of the animal previous to the induction : I proceed, therefore, to add, that, *previous to the existence of life, the body must have attained a SPECIFIC ORGANIZATION*; and that *Life*, or, in other terms, *the Vital Action*, is induced by the application of proper stimuli: thus, then, *life in the animal is that state of action (induced by specific stimuli upon matter specifically organized), by which the animal functions, or any of them, are carried on.* To the whole of this, I know, may be objected, the assertion of that great man, whom, with such repeated arrogance, I have ventured to oppose: namely—That Life may exist without matter, being in “ a state of action, and the property of self-preservation may “ alone be present, Life being at the same time present in its “ full force.” To the solitary instance, however, brought in support of this assertion, I must reply, that the life of the Egg is by no means obvious to my understanding; for, although the Egg be so far organized as to be endowed with the principle of self-preservation; so, also, are various fruits, &c. whose Vitality, I suppose, after they are plucked, will not be contended for *. In short, it does not appear to have any one property

* Some, perhaps, will contend for the life of the kernels, seeds, &c. I, however, should content myself with contending for their specific organization; by which, upon the application of proper stimuli, they are rendered susceptible of Life.

property or attribute, which, in any other substance, would be deemed a sufficient test of Vitality, till the stimulus of heat, being properly applied, so meliorates the arrangement of particles, as to induce the *specific organization* essential to the susceptibility and production of Vital Action.—By this, then, it will appear, that I consider *the preliminary principles of life* to be a *specific organization* and a *specific stimulus*; *the perfect contact of these* to be *the immediate cause*, and *life itself* to be *the state of action produced by this union*.

It will now only be expected, that I should give an opinion upon the nature of the stimulus required. But, in order to do this, I must first premise, that I consider the Blood, independent of its nutritive power, as the specific medium by which the stimuli must be conveyed to the different parts of the organized frame, so as to produce the Vital Action. This Blood, then, in its passage through the Lungs, collects a something, which generates a *specific* heat (for it is evident, that heat, unless thus generated, will not answer the purpose), which it diffuses through the whole vascular system, and then (exhausted of its vivifying power) returns again to the lungs, to exhale whatever noxious particles it may have collected, and to inhale a fresh portion of the same vivifying principle. But what is this something—this vivifying principle?—Is it atmospheric air itself?—Certainly not. The coats of the arteries, and the membranous linings of the cells of the lungs, forbid the access of such an element; besides, it has been
proved

proved by experiment, that in the arteries of the living body there is no air. Something, however, it must be, that is contained in the atmosphere, and something of a powerful and exquisitely subtle nature.

If, then, we look upon the component parts of our atmosphere, what can we discover so competent to the task—so subtle, so powerful, so nearly approaching to that idea of an ethereal medium, which some philosophers have supposed necessary to complete the chain of connection between the divine immortal essence, and the dull inertion of created matter, as the electrical fluid?—that principle, whose presence, under such a variety of forms, is constantly presenting itself to the researches of the philosopher!—whose agency, in so many of the phenomena of Nature, we are daily detecting! and which, perhaps, will one time be discovered to be the real principle by which all heat and action are originally generated and maintained!

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